

CLAIMS

1. An electronic device for image processing (1) generating an output image from an input image, the two 5 images being composed of pixels, the input image originating from a first video sensor (2) and representative of a scene containing at least one discrete light source, said input image containing a first representation of said discrete light source, the 10 output image comprising a second representation of said discrete light source, characterized in that said device comprises at least:
 - an electronic unit (5) for improving contrast making it possible to provide on the basis of the 15 input image an image with better contrast;
 - an electronic unit (6) for selection making it possible to provide on the basis of the image with better contrast a filtered image now containing only at least a first set of pixels whose 20 electronic level is situated above a first threshold, said first set corresponding to the representation of at least one potential light source;
 - an electronic likelihood estimation unit (7), 25 making it possible to provide on the basis of the first set of pixels of the filtered image an estimated image comprising a second set of pixels, said second set corresponding to the representation of estimated light sources, the 30 distributions of the pixels of the representation of the estimated sources corresponding to bidimensional mathematical functions; with each representation of estimated light source there being associated a likelihood probability;
 - 35 • an electronic unit (8) for validation providing on the basis of the estimated image the final image, said image containing a representation of the estimated light source if the associated likelihood probability is greater than a second

threshold.

2. The electronic device for image processing (1) as claimed in claim 1, characterized in that the level of
5 the first threshold depends at least on said validation unit (8).

3. The electronic device for image processing as claimed in claims 1 or 2, characterized in that said
10 electronic function for improving the contrast of the initial input image comprises at least one matrix filter of CBF (contrast box filter) type applied to each pixel level of the initial input image to obtain the contrasted input image.
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4. The electronic device for image processing as claimed in claim 3, characterized in that said matrix is a square matrix of M rows and M columns of elements, the N central elements having one and the same first
20 value, the other $(N - M^2)$ elements of the matrix having one and the same second value equal to said first value multiplied by $N/(M^2-N)$.

5. The electronic device for image processing as
25 claimed in one of the preceding claims, characterized in that the electronic likelihood estimator (7) comprises at least one electronic function (71) for recognition of the shape of the representation of the light source making it possible:
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- to compare the levels of the pixels of the first set of the filtered image with calculated levels, emanating from predetermined mathematical functions
- to provide a probability of presence of the representation of the estimated light source in
35 the input image.

6. The electronic device for image processing as claimed in claim 5, characterized in that the

predetermined mathematical functions are bidimensional Gaussians.

7. The electronic device for image processing as
5 claimed in claim 6, characterized in that the
recognition function is effected by applications of the
method of least squares between the levels of the
pixels of the first set and the calculated levels.

10 8. The electronic device for image processing as
claimed in one of the preceding claims, characterized
in that, the filtered image comprising at least two
representations of potential light sources, the
electronic likelihood estimator comprises at least one
15 electronic function (72) the recognition of for
geometrical disposition of said representations, said
function providing a probability of alignment of said
representations of the light sources in the input
image.

20 9. The electronic device for image processing as
claimed in claim 8, characterized in that when the
representations of the potential sources are aligned
along at least one straight line, the electronic
25 recognition function comprises at least one function
making it possible to effect a radon transform on the
pixels of the filtered image.

10. The electronic device for image processing as
30 claimed in one of the preceding claims, characterized
in that, the representations of the sources being
mobile in the input image, the electronic likelihood
estimator comprises at least one electronic function
(9) for modeling displacement of the representations of
35 the estimated sources.

11. The electronic device for image processing as
claimed in claim 10, characterized in that an
electronic likelihood estimator (7) comprises at least

one electronic function (73) for estimating displacement making it possible, on the basis of the electronic function for modeling displacement of the representations of the estimated sources:

- 5 • for each representation of estimated light source of a first estimated image occupying a first position, to calculate the theoretical displacement of said first position;
- 10 • to calculate a second position occupied by said representation of the estimated light source in a second input image;
- to compare said second position with the real position of said representation of the light source in said second input image.
- 15 • to provide a probability of displacement of the representation of the source in the input image.

12. The electronic device for image processing as claimed in one of claims 4 to 11, characterized in that, the probability of the likelihood of the representation of an estimated light source provided by the electronic unit (8) for validation is equal to the product of the probabilities of presence, of alignment and of displacement of said representation of the light source that are provided by the electronic estimation unit.

13. The electronic device for image processing as claimed in one of the preceding claims, characterized in that the electronic unit (8) for validation calculates a rate of rejection of the input image equal to the percentage of representations of estimated sources whose likelihood probability is situated above the second threshold over the total number of representations of estimated sources.

14. The electronic device for image processing as claimed in one of the preceding claims, characterized in that the device comprises an electronic histogram

unit (10) making it possible to construct the histogram of the pixels of the image with better contrast, said histogram providing the number of pixels corresponding to a given energy level.

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15. The electronic device for image processing as claimed in claim 14, characterized in that the electronic histogram unit (10) comprises a function making it possible to determine a third threshold, the 10 level of said third threshold being situated above the mean level of the pixels of the filtered image and below the mean level of the pixels of the representations of the potential light sources.

15 16. The electronic device for image processing as claimed in claim 15, characterized in that, the histogram being represented in the form of a graph having as abscissa the level of the pixels and as ordinate the number of pixels corresponding to this 20 level, the level of the third threshold corresponds to the level which lies at the largest distance from the straight line passing through the maxima in abscissa and in ordinate of the histogram.

25 17. The electronic device for image processing as claimed in one of the preceding claims, characterized in that the device comprises an electronic unit (11) called a recursive filter which determines for a second input image subsequent to a first input image, the 30 value of the first threshold to be applied to this second image, the value of said first threshold depending at least on the value of the first threshold, of the third threshold and of the rate of rejection of the first input image.

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18. The device for image processing as claimed in one of the preceding claims, characterized in that the final image is projected in a viewing system (3) superimposed with an image originating from a second

sensor.

19. The electronic device for image processing as claimed in claim 18, characterized in that the first
5 sensor (2) is sensitive in the near infrared in the 1 to 2 microns band and the second sensor is sensitive in the middle infrared in the 5 to 20 microns bands.

10 20. A viewing system comprising at least one video sensor (2), an electronic device (1) for image processing and a viewing device (3), characterized in that said system possesses means for locating the position and orientating the video sensor in space, said image processing being according to one of the
15 preceding claims, said locating means being interfaced with said device (1), it being possible to render said system mobile.

20 21. An aircraft characterized in that it comprises a viewing system as claimed in claim 20, the viewing device being a so-called head-up viewfinder, the light sources being runway lamps.